THE FEEDING OF MINERAL SUPPLEMENTS TO LIVESTOCK

By H. H. Mitchell

In the feeding of livestock, minerals should be used only as supplements to rations that are properly balanced in other respects, particularly in respect to protein. The proper use of protein-rich supplemental feeds will improve farm rations far more than will mineral mixtures, and at the same time will reduce the need for minerals or may even supply all the minerals needed.

Altho animals need a large number of mineral substances, ordinary farm rations supply most of them in more than the amounts required. Only under special conditions are mineral supplements really needed. In fact, for certain classes of livestock they are needed rarely if at all.

Mineral supplements, therefore, need contain only a few minerals in which farm feeds are known to be deficient, and these can be obtained at low cost and mixed on the farm.

Circular 411

University of Illinois · College of Agriculture
and Agricultural Experiment Station

Printed for use in

EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS

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Urbana, Illinois *Revised December, 1938* August, 1933

Printed in furtherance of the Agricultural Extension Act approved by Congress May 8, 1914.
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The Feeding of Mineral Supplements to Livestock

By H. H. Mitchell, Chief in Animal Nutrition

THE MINERALS in which farm rations *may be* deficient are *calcium, phosphorus, sodium, chlorin,* and very rarely, *iodin.*[1] There is little evidence that farm rations, in the Middle West at least, are ever deficient in any other minerals. Those needed can be supplied largely in ordinary farm feeds.

Calcium-rich feeds are the legume roughages (clover, alfalfa), milk products, tankage, meat scraps, and fish meal.

Phosphorus-rich feeds are wheat bran, wheat middlings, soybeans, soybean oil meal, cottonseed meal, linseed meal, milk products, tankage, meat scraps, and fish meal.

Sodium and **chlorin** are readily and cheaply supplied in common salt.

Iodin is not plentifully supplied in any common farm feed.

Feeds which are excellent sources of one mineral may, however, be deficient in other minerals, and rations must therefore be so balanced as to protect against such deficiencies.

Seeds and seed by-products are particularly deficient in *calcium* and very probably deficient in *sodium* or *chlorin* or both.

Whole grains are possibly somewhat deficient in *phosphorus* for growing animals, especially poultry.

Roughages are deficient in *sodium;* in certain areas they may be deficient also in *phosphorus.*

Nonlegume roughages and pastures are not reliable sources of minerals, particularly if grown on acid and nonfertile soils; they may be deficient in both *calcium* and *phosphorus.*

Furthermore the need for mineral supplements depends upon the condition of the animal as well as on the ration fed. Young growing animals, pregnant and lactating females, and laying hens require a greater concentration of minerals in their rations than do mature animals not burdened with the extra demands of reproduction or milk secretion.

[1]In certain regions of this country, particularly in the northwest states, heavy losses have occurred in restricted localities among new-born pigs, lambs, calves, and foals due to goiter, the young being born dead, or weak and hairless, or nearly so. Occasionally goiter develops after birth among growing animals in these regions, especially among calves. This condition is due to a deficient supply of iodin in the food and water supplied to the dam during her gestation period. Apparently the feeds or the waters in these parts of the country do not at all times contain sufficient iodin. In Illinois sporadic cases of iodin deficiency among farm animals have been reported, but the number of such cases does not suggest that iodin deficiency in livestock is peculiar to any specific district in the state. The general use of iodin in mineral mixtures is neither necessary nor advisable.

NEEDED MINERALS AVAILABLE IN CHEAP FORMS

Obviously when rations contain considerable amounts of feeds rich in *calcium* or *phosphorus,* the necessity for using mineral supplements is removed entirely or greatly reduced. When, however, mineral supplements are needed, they can all be provided in cheap forms.

Calcium in high-grade limestone, ground oyster shell, and steamed bone meal. These are excellent sources of calcium. High-grade limestones are very nearly pure calcium carbonate. Dolomitic limestones (containing variable amounts of magnesium carbonate) are poorer in calcium but otherwise seem to be satisfactory supplements for growing animals.

Calcium may also be provided in spent bone black, in wood ashes, in rock or acid phosphate, or in slaked lime, tho these sources are not so satisfactory as high-grade limestone and steamed bone meal. There are some objections to rock phosphate because of the fluorin it contains, which makes it toxic when given in unrestricted amounts to farm animals. It should always be used with caution and never included in mineral mixtures that are to be fed free choice.

Di-calcium phosphate is an excellent source of calcium and phosphorus but no better than minerals selling for less money.

Phosphorus in steamed bone meal, di-calcium phosphate, rock phosphate, or acid phosphate. Altho bone meal is much to be preferred, any one of these materials will supply phosphorus in more or less satisfactory form.

Sodium and chlorin in common salt. A coarse salt, such as is used in the ice-cream industry, has some advantages when salt is being fed alone. When mixed with other minerals, fine salt may be used. Block salt, suitable for sheep, cattle, and horses, is too hard for swine, and is unsatisfactory for dairy cattle in winter.

Fineness not important. The degree of fineness to which minerals are ground for livestock is not a matter of great importance; particularly is this true of limestone. In fact, if minerals are so finely ground as to be dusty, they may be unpalatable for livestock.

SIMPLE MIXTURES ARE EASILY COMPOUNDED

From what has been said it is evident that mineral mixtures for livestock need include only a few substances. They should all contain common salt and a calcium supplement. As a measure of safety some form of calcium phosphate may be used, particularly for dairy cows and for growing animals subsisting mainly on pastures grown on poor soils. Soils deficient in phosphorus for crop production may be expected to produce phosphorus-deficient forage crops.

A mixture composed of *two parts of ground limestone and one part*

of salt will supplement *calcium* deficiencies satisfactorily, and for rations containing adequate amounts of a high-phosphorus protein concentrate it is the best, cheapest, and most convenient mixture to use.

A mixture composed of *two parts of steamed bone meal and one part of salt* will supply both *calcium* and *phosphorus* in a favorable ratio and in readily available form.

A mixture composed of *equal parts of finely ground limestone, steamed bone meal, and salt* will supply *much more calcium than phosphorus,* and for rations deficient in both calcium and phosphorus it is a more logical mixture than the preceding, as well as a cheaper one.

A convenient way in which to supply the necessary *iodin,* in localities where goiter has been experienced, is to use iodized salt[1] in the mineral mixtures for pregnant females in the proportion of 1 pound for each 100 pounds of grain.

COMPLEX MIXTURES ARE NOT NEEDED

Aside from the need for *common salt* and *calcium* and *phosphorus,* there are instances, exceptional in Illinois, when other minerals, such as *iodin* and *iron* (and possibly *manganese*), are called for in the feeding of livestock. *But these instances do not justify the use of complex mineral mixtures in general practice.*

Commercial mineral mixtures are frequently loaded with minerals, needed by the animal it is true, but contained in adequate amounts in the feeds the animal will consume. They are often even more complicated than this, extending into the fields of medicine and sanitation. Many mixtures now being sold in Illinois are loaded with laxatives, worm expellers, tonics, and other substances of even less certain value, such as charcoal and sulfur. But healthy animals do not need such treatment, while sick animals need treatments suited to the particular disorders from which they are suffering. Such medicated mixtures cannot effectively combat intestinal parasites or constipation; to do so they would have to be given in such doses as to interfere seriously with the appetite and the vigor of the animal. Nor can their use in any way diminish the need for sanitary measures in livestock management. Furthermore, the more medicines and tonics that mineral mixtures contain the less of the essential calcium and phosphorus compounds that will be found in them.

The practice of including in commercial mineral mixtures many more components than are necessary for the proper supplementing of farm rations increases the cost of the mixture far beyond its inherent value as a supplement in animal feeding.

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[1]An iodized salt containing as little as 1 or 2 ounces of potassium iodid to every 300 pounds of salt is safe, effective, and inexpensive in preventing goiter. In using salts containing much larger proportions of iodid there is danger of overdosage. Sheep seem to be particularly susceptible to iodin poisoning.

FARMERS CAN MAKE OWN TESTS

To farmers who believe that commercial minerals have served them well in their business and who are steady users of them, it may be suggested that the active ingredients in these mixtures which are doing *all* of the good work are the limestone, or the bone meal, and the salt contained in them.

Those who are inclined to be skeptical would find it profitable to test out for themselves on their own farms the value of the complex mineral mixture which they are using in comparison with a simple home-compounded mixture. The little extra work required would represent time well spent if it saved most of the money that they are now spending for commercial mineral mixtures.

A farmer making such a test should not be favorably impressed if his animals consume a greater amount of the commercial mixture, for these mixtures often contain appetizers, such as anise, fenugreek, dried yeast, molasses, and licorice, which are added in order to induce animals to consume the mixtures, whether or not the minerals they contain are needed. The more these ingredients cater to the animal's appetite, obviously the more of the mixture will be used and bought. A farmer may rest assured, however, that if pigs, for example, need minerals they will consume a simple homemade mixture, and if they do not consume such a mixture, it is highly probable that they do not need it.

NEEDS OF DIFFERENT CLASSES OF LIVESTOCK

Swine. Salt should be fed to all swine irrespective of their rations. This is the only mineral supplement needed when enough tankage, skim milk, or buttermilk is fed to balance the ration in protein.

The calcium deficiencies of a corn ration will in general be adequately taken care of by including in the ration about 5 percent of tankage (60 percent protein), or 9 percent of the Wisconsin trio mixture (tankage 2, linseed meal or soybean meal 1, and alfalfa meal 1), or by feeding about 4.7 pounds of skim milk for each pound of corn.

Legume pasture, if abundant, fills or reduces largely the need for calcium supplements. Three pounds of fresh alfalfa daily is probably sufficient to supply the calcium requirements of a 100-pound pig. If the protein supplement is of vegetable origin (one of the oil meals, for example), a calcium supplement is needed. The mineral mixture selected (pages 4-5) is most conveniently self-fed. If incorporated in a grain mixture to insure its consumption, 2 percent of it should be enough.

A special need for iron salts develops in pigs farrowed in the late winter and early spring months and kept in a barn for 4 to 6 weeks with no access to soil and forage. Under these conditions the

little pigs become severely anemic, because milk is extremely deficient in iron salts. Their breathing becomes labored (thumps), they take on a swollen appearance, especially around the head and shoulders, become weak, and often die unless their diet is corrected with iron salts. The iron salts needed are most easily and effectively got to the pigs by smearing on the dam's udder a solution of commercial iron sulfate[1] (or other soluble iron salt) in water. The little pigs then take their iron supplement when they take their milk.

Chickens. Chickens should be provided with common salt at all times. From ½ to 1 percent of common salt should be added to the ration of both chicks and hens.

When rations for growing chicks or laying hens contain as much as 10 to 15 percent of meat scrap, tankage, or fish meal, depending upon the content of calcium, it is not necessary to include any additional calcium or phosphorus in the form of mineral supplements. Milk products are much less efficient in this respect; about 65 percent of them (on the dry basis) would be required in a ration in order to supply as much calcium as 10 percent of tankage supplies. When meat scrap, tankage, or fish meal is replaced in whole or in part by vegetable protein concentrates, the mineral deficiency may be corrected by adding 1 pound of steamed bone meal (or of a mixture of equal parts of steamed bone meal and limestone) for each 4 to 5 pounds of supplement replaced. Laying hens also have a very high calcium requirement for egg-shell formation and should be given free access to oyster shell or other satisfactory form of calcium carbonate, at all times.

Excessive feeding of minerals may have an unfavorable effect on growth and bone formation and should therefore be avoided.

Rations consisting too largely of corn, milk products, meat scraps, and bone products may be deficient in manganese both for the breeding flock and for growing chicks. Hens will produce eggs of low hatchability, containing deformed embryos, and chicks will develop perosis or slipped tendon. The condition can be prevented by substituting oats for half the corn in the ration; by the inclusion of high-manganese feeds, such as wheat bran, standard wheat middlings, and rice bran; or by adding to the ration as little as 4 ounces of manganese sulfate per ton of feed.

Beef cattle, sheep, and horses. When raised on nonlegume forage, especially if the soil is acid, beef cattle, sheep, and horses should usually be given calcium and phosphorus supplements. A mixture of limestone, steamed bone meal, and salt in equal parts is conveniently self-fed.

[1] A solution containing 1 pound of either hydrated ferric sulfate or copperas in 3 quarts of water is effective when applied to the udder once daily.

If these animals are on good legume forage, no such supplements are needed, tho free access to salt should be provided at all times.

Dairy cows. All dairy cattle except young calves should be given free access at all times either to boxes of fine salt or to block salt. In addition, an excellent plan for dairy cows in milk is to include 1.5 to 2 pounds of salt in 100 pounds of grain mixture.

Calcium may be deficient in dairy rations that include no legumes, particularly if the roughage is grown on acid soils or on soils of low fertility. Roughages grown on soils rich in lime may contain twice as much calcium as the same kinds of roughages grown on highly acid soils.

According to present knowledge, legumes, used either as pasture crops or as well-cured hay, are the best sources of calcium for dairy cows. When legumes cannot be supplied, calcium may be furnished in ground limestone or in steamed bone meal of feeding grade. These may be mixed with the grain at the rate of 1 to 2 pounds for each 100 pounds of grain mixture or, for cows on pasture, a mixture consisting of equal parts of bone meal, limestone, and salt may be supplied in boxes to which the cattle have free access. *Rock phosphate has been found to produce such harmful results when fed to dairy cattle that its use is no longer advised.*

Phosphorus may be deficient when the dairy ration is made up largely of roughage, since most roughages contain relatively small amounts of this element. Roughages grown on soils poor in phosphorus may be especially low in phosphorus. This deficiency, which may lead to very serious disturbances in the health of the animals, can be remedied easily. The best way usually is to supplement grain mixtures with feeds that are good sources of phosphorus as well as protein. If the grain mixture contains as much as 5 percent of cottonseed meal or wheat bran, 8 percent of linseed meal, or 12 percent of soybean oil meal, it probably is adequately supplied with phosphorus, tho not necessarily with protein. *Steamed bone meal is the best mineral for remedying phosphorus deficiencies when inadequate amounts of high-protein feeds are used.*

Unless evidences of iodin deficiency have been observed, no benefit is likely to be derived from feeding iodin supplements to dairy cattle. The deficiency is evidenced by the presence of goiter in the calf at birth or by the development of goiter soon after birth. The trouble is easily prevented by substituting iodized salt for ordinary salt supplied to cows during the last five months of pregnancy. Fish meal and kelp are also possible sources of iodin for cattle, but may be more expensive than iodized salt.

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